SCIENCE

A WEEKLY JOURNAL DEVOTED TO THE ADVANCEMENT OF SCIENCE, PUBLISHING THE OFFICIAL NOTICES AND PROCEEDINGS OF THE AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE

FRIDAY, JULY 12, 1907

CONTENTS

The American Type of University: DR. ANDREW S. DRAPER 33

Scientific Books:—
Kraemer's Text-book of Botany and Pharmacognosy: PROFESSOR H. H. RUSBY. *The Cambridge Natural History:* G. N. C. 43

Scientific Journals and Articles 45

Societies and Academies:—
The St. Louis Chemical Society: DR. C. J. BORGMEYER 46

Discussion and Correspondence:—
Dr. Eastman's Recent Papers on the Kinship of the Arthrodires: PROFESSOR BASHFORD DEAN. *Evolution Theories—Static, Determinant, Kinetic:* DR. O. F. COOK ... 46

Special Articles:—
Ionization in Closed Vessels: W. W. STRONG. *Laboratory Apparatus for Measurement of the Force on a Current-carrying Conductor living in a Magnetic Field:* PROFESSOR R. A. PORTER 52

Quotations:—
The New England College 56

Notes on Organic Chemistry:—
Anhydrous Sulphocyanic Acid: PROFESSOR J. BISHOP TINGLE 56

Geologic Work on the Coastal Plain..... 57

Cinder Cone National Monument 58

An International Commission on Sleeping Sickness 58

The International Association of Academies . 59

Address on the Occasion of the Dedication of the Linnæan Bridge 59

Scientific Notes and News..... 60

University and Educational News 64

MSS. intended for publication and books, etc., intended for review should be sent to the Editor of SCIENCE, Garrison-on-Hudson, N. Y.

THE AMERICAN TYPE OF UNIVERSITY[1]

Mr. Chancelor, and Ladies and Gentlemen, and, more particularly, you young men and women of the Class of 1907:

There is no more fascinating, indeed no more exhilarating, spectacle than a commencement scene in an American university, on a clear and bracing morning in the rosy month of June.

It is not only the hour when an eager and ambitious class—justly proud of substantial intellectual accomplishments, with the proper confidence which comes of very considerable intellectual discipline, truly courageous and sanely idealistic through much contact with the very best in human life—receives the standard stamp of approbation and commendation which the best scholarship can give; but it is also the hour when the university comes out into the open and presents to the activities of actual life the finest new energies which it can generate and train.

There are universities—and many of them—in other countries which never have commencements. They give credits for work done, and when one has enough credits he exchanges them for a degree. I say *he* because the women have little or nothing to do with it. The whole thing is as guiltless of ideality, of imagination, of incentive, of spirit in any form, as the building of a canal-boat or the buying of a pair of shoes. There are universities in this country which have inherited so much from

[1] Commencement address at Syracuse University, June 12, 1907.

the universities of the old countries that they are able to understand the spirit and meet the educational needs of the United States only with the greatest difficulty and only in the most apprehensive, ponderous, and distressing kind of way. And there are universities in all countries which have inbred so much, which are so self-satisfied, which have got so much transmitted 'culture' which did not come through heavy work, that they are innocently unjust and necessarily unfair to the people upon whom they must depend for the continuous reinforcement of virile life. There is a scholarship so unemotional as to be gloomy, so aristocratic as to be useless, so 'cultured' as to be insipid, so cynical as to be tormenting; but scholarship of the modern type in America has little in common with it.

The great fact that makes a university commencement in our country of such absorbing popular interest is that it is the annual occasion of an *American* university. The world sees, if willing to see, a new type of university in this country in the last half-century. Let us inquire, with necessary brevity, how it has come to be, and what are the features which distinguish it.

All of the older social systems of the world, no matter how proficient in political philosophy or in the arts and sciences of civilization, have shown a distinct cleavage between the upper and the nether classes. The names of things have been different in different countries and the things themselves have had all manner of forms and colorings, but the fact has been well-nigh universal that there have been two great classes and that a small higher class has ruled a much larger lower class. As universally as this has been true, the universities have been the creations and have reflected the outlook and executed the purposes of the higher class. The outlook of the higher class has seldom caught a glimpse of the wisdom of giving every one his chance, and the self-interest of that class has never been much tempered by anxiety for widely diffusing a universal learning. The change has come through the fact that in this country the larger class is having something to say about it.

Until in our country, and practically in our time, the university has stood for some manner of exclusiveness. It may have been for a monarch and what he implies; it may have been for a more or less constitutional state; it may have been for a church; it may have been for a profession or a guild: never, until now and here, has it stood for all learning and for all the people.

This was almost as true of early American as of foreign colleges or universities. We too often forget—if, indeed, we have ever realized—that our American democracy, with its great elements of toleration, equality before the law, free right of opportunity for all, no special privileges, and with its public institutions of equal service to all, did not all at once come full-fledged into the world by the migration of a few thousand people of well-settled notions across the sea. The common thought and the social and institutional life of the old world persisted in the new world. Harvard, William and Mary, Yale, Princeton, Columbia, Pennsylvania, Rutgers, Brown, Dartmouth, all stood for aristocracy in the state, for denominationalism in religion, and for a learning which was exclusively culturing and professional. They never dreamed of uplifting the common people or of applying scientific research to the industries of the country.

It does not signify any lack of appreciation of the great qualities which the early settlers brought to this country, to say that the dominant and distinguishing thought of the nation has come from the compound-

ing of a new nation out of pretty nearly all kinds of people in the world. The very necessities of the situation have broken down all general distinctions between classes and brought forth a national political philosophy with a universal freedom of initiative and a popular efficiency in consummation which the world has never seen before. It is this which has made a new manner of university. It has remodeled the earlier universities and it has brought very quickly into vigorous life many powerful institutions which stand for the universal purpose to promote the universal good. Some of them have resulted from the benefactions of a man of wealth, some from the leadership of a great executive and the work and love of a multitude of others who had little besides work and love to give, and some through the popular determination working through the political machinery of the state. But *all* have had to appeal to a constituency which was wider than any class, or sect, or party, and such as have been able to meet the needs of such a constituency have found overwhelming support and response to their ability to do it.

It is interesting to note that the university development has been strongest where our democracy has been the freest. As new states were settled to the westward by a people who lacked little in moral purpose and nothing in initiative or in courage, they not only took good care of an elementary school system but commonly provided for a state university in their new constitutions. The older states could not do that when *they* were organized because neither legal opportunity, nor political philosophy, nor educational theory, nor the force of popular initiative were up to the point of doing it at that time. And the lead in freedom and in force of popular initiative which the newer states gained from the fulness of their opportunity, they seem likely to hold. They are certainly diffusing the higher learning more completely among all the people without regard to heredity or wealth than any other people in the world. They have established proprietorship in a universal school system of sixteen grades, beginning with the kindergarten and continuing along a smooth and unbroken road up to and through the university, which is unique in the history of education. They see, as most of us in the east do *not* see, that the logical educational result of our fundamental political theory, that every child of the republic shall have equality of opportunity, leads to a university so free at least that none who is prepared for it and aspires to it shall fail to get it only because he lacks the money to pay the cost. It is as inevitable as the natural outworking of our political philosophy is certain that this ideal will obtain in the course of time wherever the presence of the flag of the union determines the educational policy of a people.

When it was settled that we were to have a universal public high school system all over this country, it was practically settled that we should have a public university system as well. One thing in intellectual evolution and educational opportunity accomplished in America, another thing—and a higher thing—will follow almost as a matter of course. If one asks where it is to end, the answer must be "I do not know." The hereafter ought to have some things to settle, and that is one of them.

The building of public high schools made it certain that the colleges already established would have to forego much of their exclusiveness and that there would be new colleges and groups of colleges in which the control would not be with any class.

The great difficulty with the systems of education in other lands is not that they

have no elementary school system. They very generally have excellent ones. Attempting less than we do in the primary schools, they sometimes do it better than we do; and, better still, they have less difficulty than we do in making every child attend upon the instruction provided for him. Nor is the difficulty that they have no university system. Very generally they have an excellent one, from which we have much to learn. The difficulty is that there is no connecting link between the two, and that it is not intended that there shall be one. There is not only no continuous road from one to the other, but there are insurmountable barriers between them. The universities serve an exclusive class, and no matter how educationally entitled a child of the masses may be, it is difficult, almost to the point of prohibition, for him to secure the advantages of the advanced schools.

That is the thing which the fundamental political philosophy and the deliberate democratic purpose of this country are obviating. It is not that any of us are against all the exclusiveness that anybody wants in his private or family life. We all want some of that ourselves; it is a matter of temperament, of congeniality, of experience and of taste, and in personal affairs these are to have their way; but the public policy of the country will give every one his public chance, his equal opportunity—at least so far as the common wealth and the common political power are used to create individual opportunity at all.

Happily, the high-school movement in America has proved to be a great disorganizer of classes, as well as a great help to the diffusion of higher learning. It has made men and women of all classes know each other better and regard each other more. It has gained and retained the interest of many of quick mentality, marked business success, and newly-acquired wealth in popular education. It has been the secret spring of many a great gift to a university, and of much munificence for the common good.

And, whatever else it has done, it has created an overwhelming influence for the development of universities and for determining the essential features of new universities in America. There was reason for the earliest and most decisive manifestation of this movement in the newer states. There were no old-line academies and colleges there to stand in the way of it. The settlers were of the finest New York and New England stock: they knew about the very best in education. The parents were ready to lay down their all, even their lives, for their children; and they had a clear field. Of course, with such a people the school house became the most conspicuous building in the pioneer village, and of course a little 'college' sprang up in every considerable town. Of course, again, with such a people the public high school had its quickest and perhaps its most luxuriant development. The sooner the high school became a fact the sooner higher education became a passion. When the federal land grants were made to higher education in all the states, right at the darkest hour in the Civil War, the eastern states hardly knew about them at all, and have never made more than perfunctory and indifferent use of them, while the western states have seized them with avidity, put them to their utmost possibilities, added to them from ten to an hundred-fold, and cry for more with an eagerness and an audacity that would have made young Oliver Twist a veritable hero.

And these federal land grants in themselves have had much to do in fixing the predominant type of university in America.

With them, with the complete recognition of the principle that it is within the functions of a democratic state to do—or to delegate the legal power to do—whatsoever the people want to do for learning, and with general education boards with millions at their disposal every year for the higher institutions, it is not difficult to see that the colleges and universities in America which will endure will minister to all the people, without reference to their means, and will promote every phase of honorable endeavor without regard to class or station.

Let it not be inferred that the typical American university is, or is to be, the poor man's university. It is not to be burdened with any qualifying adjectives. It is to be the rich man's and the poor man's alike. Its strength is, and is to be, in the fact that it is representative of the common life. It is to be no more exclusive than the constitution of the country is exclusive, save upon the one point of ability to do its work. It brings rich and poor, men and women, together upon the basis of advanced scholarship, and it gives intellect an opportunity which is distinctly higher and nobler than any that can follow the mere accidents of birth or the mere incidents of life.

No university can be a real or an effective American university and follow the exclusive educational ideals of other countries and other times. A new nation has been compounded in this country out of people from all social, industrial, political and moral conditions in the world. That nation is working out its own salvation. It is doing it upon lines that are peculiar to itself. I think it is doing it safely and effectually. The net result will be the freest and the finest uplift to the intellectual and moral state of men and women that the world has ever seen. This thing is not only going through this nation, but, largely through the instrumentality of this nation, it is going through the world. It must, of necessity, create instrumentalities which are peculiarly its own. Above all, its educational institutions of the first rank, which must regulate the ebb and flow of the nation's best and truest thought, can not be limited by ideals which had reached their zenith before our nation was born and before our political science had begun to make its revolutionary impressions upon the thinking and the destiny of mankind. Nor, indeed, can we be limited by conditions which prevail at this time in other nations and their institutions. Without, by any means, descending to the low level of declaring that things in this country are better than things in other countries only because they *are* in this country, and cheerfully recognizing the vastness of the knowledge we are yet to gain from other lands, I dare make the declaration, in words that will leave little to be misunderstood, that we can not follow the British university, with its narrow, purely classical and purely English scholarship, which is studiously prevented from being broadened by that fatuous policy of the ruling classes which stubbornly refuses the organization of all secondary schools through which the only people who can broaden it may come to the universities at all. We can not accept the scheme of the French universities, overbalanced as they are with the mechanical and the imaginative, and dominated by the martial feeling and the military organization of a people who need the opportunity of thinking freely above all other things. Nor can we copy the German university, which puts the scientific method first, regards sound morals but little, and conveniently absolves itself from all responsibility about the character of its students, so long as they can use a microscope to magnify the strength of the empire. And

if we can not be guided by the English or French or German universities, we can not be guided by any. We will take and we will leave whatever will serve our ends either by taking or leaving. We will build up institutions which make for scholarship, for freedom and for character, and which, withal, will look through American eyes upon questions of political policy, and train American hands to deftness in the constructive and manufacturing industries of most concern to the United States.

There has been no more noteworthy or promising development in our intellectual, political, or industrial life than the flocking of students in recent years to the universities which show a rational appreciation of the educational demands of our American life, and a reasonable disposition to meet the needs of the educational situation. Even where a university is not situated in a large city and is not sustained by an attendance which *will* go somewhere and can go nowhere else, it has stood in no need of students or of support if it could enter into the spirit of the Republic and would offer sound instruction which had some human interest and some real bearing upon practical training for our own professional and industrial life.

A mere English or culturing training, no matter how excellent and necessary a thing in itself, is no longer a preparation for the professions. The legal profession demands that and also a great and varied special library; a knowledge of legal history and theory; certainty about the statutes and the decisions; aptness at associating all in a comprehensive and logical whole, and readiness at applying the correct parts to new cases. It requires years of study under expert and practical teachers, with ample accommodations, in a special school, almost necessarily associated with a university. Medicine claims the English training, and then exacts years of research in chemistry, zoology, bacteriology, physiology and other fundamental and kindred sciences, requiring great laboratories and costly equipment which can hardly be provided at all outside of the great universities. After that, the theory and practise specially appertaining to the profession must have a special school, and again almost necessarily, one associated with a university. It is the same with architecture, and engineering, and agriculture, and all the professional and industrial activities of the country. It is even largely so with the fine arts. All demand the libraries, and laboratories, and drafting rooms, and shops, and athletic grounds, and gymnasiums, and kitchens, and all the other things which only the large universities can provide, and all students do their own work more happily and absorb much from the work of the others when they get their training in association with the crowd in the university. Wherever the university offers all these things, there the students gather; there thought is free—but is very liable to have the conceits taken out of its freedom; there the actual doing outweighs the mere talk; there practical research cuts dogmatism to the bone; there honest work has its reward, and pretense its quick condemnation; there men and women measure up for what they *are* rather than for what they claim; there inspiration is given to every proper ambition, and there a great and true American university develops.

All this has led to some very sharp differentiation between the external forms and the manner of government and the plan of work of American and foreign universities. For example, the board of trustees is largely peculiar to American universities. It stands for the mass in university government and policy. On the other side of the sea there is no *mass* in university affairs. Charters run in the

name of the king; the king is the head of the university, as of the state; and the king, or the king's minister, determines the course the university is to pursue. The early American colleges were all chartered by the king; even parliament had no part in the matter. In the midst of the revolution, just following the defeat of St. Leger at Oriskany, of Clinton in his movement up the Hudson, and of Burgoyne at Saratoga, when neither king nor parliament were much in vogue in New York, and when a petition was presented to the young state government for the chartering of UNION COLLEGE, there was not a little embarrassment as to whether it should be addressed to the governor or to the legislature, and as to which should deal with it. Yankee ingenuity met the difficulty by addressing the prayer to both, and statecraft split the difference by creating the board of regents to deal with such matters. But, however chartered, the board of trustees stands for the donors, the creators and the public, in giving trend to the course of the university. The point of it is that the founders, either the donors or the public, or both, are represented in the matter.

There is no office like our *presidency* in foreign universities. The reason for this appears in the fact that there is no faculty to be gathered, assimilated, partly eliminated, reinforced, and dealt with, according to our usage. The reason for *this* is that the intellectual provender is provided upon the *European* rather than upon the *American* plan. You pay for what you get, rather than pay for everything and then take what you like. The charges are for single courses. The professor gets the fees. The thing works automatically. If he can not teach he lacks students and soon obliterates himself. So far it is well. If another comes along who can gather students, he is welcome. There is something to be said for the system, but it lacks comprehensiveness, grasp, and the strength to bear responsibility for the balanced training of youth and the harmonious evolution of character. It will suffice where the institution has no care about intellectual balance or morals, and therefore it will not do in this country. The office of president holds things together, makes the parts fit into each other, stands for the public, the trustees, the teachers, the parents and the students, and carries the whole forward to the great ends for which a wealth of money, and of holy effort, and of the world's wisdom, has been put into it. And there is nothing clearer than that the university flourishes, that is, that the purposes of all that centers in the creation are most completely accomplished, when it has a sane and capable all-round executive who can mark out a good way and has *will* enough to make it go.

The early American colleges, copied upon foreign prototypes, have had to do so much readjusting that their old friends would not recognize them, and the ones which came a little later have naturally been created to fit a situation and fall in with a very general order. From now on they will not be able, and probably they will not be disposed, to dominate university policy in the United States. They will be obliged to work in accord with the overwhelming number of universities, colleges and secondary schools taken together. They will have to accept students *who can do their work* and who want to do it, without so much reference to how or what they have studied somewhere else. The western boys and girls say that under the accrediting system, by which institutions are examined more than students, it is easier to get into western than into eastern universities, but that, once in, it is hard to stay in a western university, while one who gets into an eastern university can hardly fail to be graduated if he will be polite to

the professors and pay the term bills. And the western people say that their way is best; that every one must have his chance; that at least his chance is not to be taken away upon a false premise; that if he "flunks out" after having had his chance it is his fault and no one is going to worry about it; and that it is better to regard the graduation standards and apply them to four years' work that the faculty must know all about than to make a fetish of entrance requirements and have so much ado about prior work—about which they can know very little at the best. It is all worth thinking about. I am not a westerner: I am thoroughly a New Yorker. But I am for the open, the continuous and the smooth road from the primary school to the university, and for every one having his chance without any likelihood of his losing it upon a misunderstanding or a hazard.

The large and strong universities will not only wax larger and stronger, but they will multiply in number. Because there will be so many of them, no one of them will serve so widely scattered a constituency as heretofore. Women are going to have the same rights as men to the higher learning. Boys will not always go to a university because their grandfathers went there. The time will come, while members of this graduating class are yet in middle life, when every large and vigorous city and the territory naturally tributary thereto will have a great university, able not only to satisfy its needs of the culturing studies but also its demands for professional and business upbuilding.

What is to become of the literary colleges? They are to flourish so long as, and wherever, they can provide the best instruction in the humanities, and do not assume names which they have no right to wear, and do not attempt to do work which they can only do indifferently. They will train for culture and they will prepare for the professional work as of yore. And wherever one does this well and is content to do so, it is to have every sympathy and support which an appreciative public can give. But no institutions, of whatever name or grade, are going to fool all the people for a great while, and the young men and women of America are going to have the best training that the world can give, and have it not a thousand miles from home. It is no longer necessary to cross the sea in order to get it, and even our own older universities are close upon the time when their work must be reinforced from the newer ones, more than the newer ones from the older ones.

Obviously, the American university, as no other university in the world, must regard the life, and especially the employments, of the people. It must exhibit catholicity of spirit; it must tolerate all creeds; it must inspire all schools; it must guard all the professions, and it must strive to aid all the industries. It must quicken civic feeling in a system where all depends upon the rule of the people. It must stand for work, for work of hand as well as of head, where all toil is alike honorable and all worth is cornered upon respect for it.

In a word, our immigration is making a nation of a wholly new order; our democracy is developing a new kind of civilization; our system of common schools, primary and secondary, has brought forth a type of advanced schools peculiar to the country. Institutions that would prosper may better recognize the fact. The universities that would thrive must put away all exclusiveness and dedicate themselves to universal public service. They must not try to keep people out: they must help all who are worthy to get in. It is not necessary that all of these institutions shall

stand upon exactly the same level; it *is* necessary that each shall have a large constituency; it *is* necessary that all shall connect with some schools that are below them. It is imperative that all shall value the man at his true worth and not reject him because his preparation has lacked an ingredient which a professor has been brought up to worship. Essentially so when, in case the boy has studied the subject in the high school, the professor is as likely as otherwise to tell him that he has been wrongly taught and that he must get what he has learned out of his head before he can start right and hope to know the thing as he ought. It is necessary that all shall be keen enough to see what is of human interest and broad enough to promote every activity in which any number of people may engage.

The American university will carry the benefits of scientific research to the doors of the multitude. It will make healthier houses and handsomer streets, richer farms and safer railways, happier towns and thriftier cities, through the application of fundamental principles to all the activities of all the people. It will train balanced men and women and therefore it will promote sport as well as work and control the conduct of students as well as open their minds. It will not absolv itself from any legitimate responsibilities which instructors are bound to bear towards youth. It will preserve the freedom of teaching, but it will not tolerate freakishness or license in the name of freedom of teaching. It will engage in research as well as instruction, but when men absolve themselves from teaching for the sake of research it will insist upon a grain of discovery in the course of a human life. We have a distinct national spirit in America. An American university will understand how that has come to be and what it is aiming at, will fall in with it, will be optimistic about it, and will help it on to its fullest consummation.

I have discussed this theme here because it ought to be realized by the people and particularly by the universities of New York; because I think the university which I have the honor to address is—quite as completely as any institution in the state—actuated by the spirit and outlook which an American university must have, and therefore because I had reason to believe my discussion would have hospitality under this roof. I would be false to my sense of justice and my standard of public usefulness if I did not say that since my return to the state it has appeared more and more clearly to me that the marvelous growth of Syracuse University has resulted from the fact that it has been moved by the true spirit of modern American university progress.

I know something of the details of university evolution. I know that many people have combined to produce this splendid evolution. It has all come from individual giving and cooperative effort. The people of this thrifty inland city have surely done much for it. The return upon the investment will be a great one—how great only a few can now foresee. The Methodist church has been true to its history, its character and its aggressive democratic spirit, in the valiant support it has given to this university. The donors who have made its equipment possible, the trustees who have kept it in the middle of the road, the teachers who have given it tone and distinction, the students and the graduates who have given it reputation for energy and valor, are all entitled to a warm word of commendation and congratulation from an educational representative of the state. And to you, Mr. Chancellor, for the

masterful management which has bound all of these factors together and wrought out this magnificent creation, I shall always, respectfully and heartfully, remove my hat.

I can not close without a direct word to this graduating class. It is essentially their day and my direct word to them has already been too long delayed. They would hardly realize that they had been graduated, without a little preachment. Young men and women, you have now learned enough to cause you to fear a little. But fear not overmuch. You are reasonably prepared for work; hesitate not to go about it. There is a place for you, but you will have to go and win it. The rivalries will be sharp; but you have as much chance as any. Your salvation is to come through work. The world honors the man or woman who loves and honors work. It makes little matter what the work may be; take a step at a time and keep doing it all the time. You will always have knowledge and strength for the next step. Think not so much about the wages as about health and responsibility and the knowledge and skill for more and better work. You are not entitled to exact much yet. Make the best of whatever opens to you. Be prudent, but not over-prudent. "A penny saved is a penny earned" is a maxim which is not true. In many a case the penny saved is a dollar lost, and it sometimes happens that it is public respect and fraternal regard lost. Do not stand aloof; certainly do not be a cynic; above all, do not get to be a freak. Keep step with the procession. It is a pretty good crowd and it is generally moving in the right direction. Have standards and stand by them. You can live by yourself and maintain your standards with little trouble, but then the standards will be of small account and you will make no more impression upon life than as though you had never lived. Reinforce yourself all the time. Accumulate a library. While you follow a business with devotion, seek recreation in literature, particularly in the literature of biography and history, that your lives may have more joy in them, that you may gain the inspiration that quickens action, that you may follow your business to the fullest measure of success and round out your years with the fullest regard of the people among whom you live. Be patient. Keep steady. Bide your time. Success in the game will not come by a chance play, no matter how brilliant, so much as by uniform efficiency and unceasing persistence. It is remarkable how men and women go up or down according to the direction they take and the regularity with which they keep at it. If you have a fair foothold at forty, you will be a round success at sixty. Be tolerant, but have faith in things. Do not let your student habit of inquiry and investigation unsettle all the faith that you learned at your mother's knee. Believe in your village, your ward, your city, your state. Sustain a church and at least some of the philanthropic effort that sets rather heavily on one half of the world but ameliorates the hard situations of the other half. Act with a party; yell for a ticket; whoop it up for the flag. Withal, don't take yourselves too seriously. You will count for more if you do not. See things in sane perspective. Have a sense of humor in your outfit. Cultivate cheerfulness. Love sport, and play for all you are worth. Don't get to be one of the lunatics who work eighteen hours a day, recognize no Sundays, and never take a vacation. Submit to no coercion. Think out what is about right and stand by it. The others will eventually have to come to it. If you find you are in error, back out without attempting to disguise it; the farther on you go the more

humiliation you will have. Be a good mixer. Give and take. Meet every obligation. On the basis of common decency make all the friends you can. Then you will carry the spirit of your university with you and do much to pay the debt which you will always owe her.

But be on the alert for special opportunities to help her. Assume not too conclusively that it must be in the conventional way. The unexpected will happen. Half a dozen years ago the richest man in the country became suddenly ill. In the absence of his regular physician he called in a young graduate of the Harvard School of Medicine and impulsively assured him that if he would get him out of that scrape he would pay any charge that he might make. The case was not serious to an educated man. The young man understood the difficulty and soon he wrought the needed cure. No bill was sent and in time it was asked for. The young physician reminded the multimillionaire of the promise. "Oh, yes," he said, "but I assumed, of course, that your charge would be within reason." The doctor's time had come. He said: "I shall make no charge, but I shall ask you to do something for me. The Harvard School of Medicine needs help. I would help her if I could. Under all the circumstances I feel warranted in asking you to look into the matter with a disposition to aid her justly, as you easily may." The old man said, "Would you like to bear a message to President Eliot?" "Yes." "Ask him to come and tell me all about it." In a week the man of wealth had given his pledge to the president of Harvard for a million when the balance should be raised, and in a month the five millions had been assured which have erected and equipped the finest plant for a medical college that is to be found in the wide, wide world.

You may not accomplish all these things, but if you will aim at them, if you will put the training of this university to its logical use, I am sure that when the long shadows come they will bring ease and comfort and honor and that when it is all over there will be peace with the hereafter.

ANDREW S. DRAPER
DEPARTMENT OF EDUCATION,
ALBANY, N. Y.

SCIENTIFIC BOOKS

A Text-book of Botany and Pharmacognosy, intended for the use of students of pharmacy, etc. By HENRY KRAEMER, Ph.B., Ph.D., A.B. Pp. 840. Illustrated with 321 plates and upward of 1,500 figures. Lippincott & Co.

To regard a piece of work as good pharmaceutical botany, under the educational conditions which have existed in modern pharmacy, is practically equivalent to a declaration that it is not good botany. The theory of professional education, that the technical study of a subject follows that of its general field, has not here applied, since, except in a very small minority of cases, such general preparation has been wanting. The teacher in the pharmacy school has been faced by the problem of presenting the technical aspects of his subject to students wholly unprepared for them. If he essays to supply this needed preparation, he encounters a strong protest from a profession that in the main regards schooling as objectionable in itself, and to be tolerated only as the necessary means to a pecuniary end. The chief interest, therefore, that inheres in a new book in this field of activity is the degree of ingenuity manifested by its author in juggling with his subject. If imbued, as most of these authors are, with a genuine ambition to improve existing conditions, he will not yield to the temptation to stand aloof, but will endeavor to smuggle more or less of the scientifically valuable into his presentation of the professionally necessary.

Professor Kraemer's book is more fortunate than those of his predecessors, in coming forward at a time of educational renaissance in

pharmacy, a renaissance, it may be remarked, that the author has had much to do in stimulating and fostering. With high ideals of professional duty, he was expected to treat his subject honestly, which he has done to a degree that quite meets the possibilities of the situation. The method followed, for the most part, is that of first presenting his subjects, then following each with its applications in pharmacy.

Eighty-one pages are devoted to an introduction to the principal groups of plants. Greater simplicity could scarcely be found consistent with the degree of concentration required. It is an encouraging sign when pharmacy students can be expected to submit gracefully to such an introduction to their botanical course and when boards of trustees will permit it. The economic relations of the groups are briefly discussed.

The "Outer morphology" of angiosperms is treated in sixty pages, and is accompanied by much excellent elementary physiology. This division of the work is far less commendable than other chapters. Nearly all the descriptive botany that the book contains is found here, and it is inadequate even for the interpretation of the following crude drug descriptions—wholly so for that of the chapters on "classification of angiosperms." The illustrations, apparently from photographs of dried specimens, are most unforunate. Many of them, even where venation is to be illustrated, are mere smudges. The author adopts the broad interpretation of the term "flower" that has had its day in application to flowerless as well as to flowering plants. The essential characteristic of the flower as being a reproductive organism that supplies a special soil for the germination of the microspore, and for the growth and development of the male gametophyte, is not hinted at, and is indeed necessarily denied by the definition adopted. Notwithstanding this fact, it is found impossible, farther on, to avoid an incidental reference to this fundamental truth. Again, the artificial denial of the nature of the sporophyll as a leaf homologue, which has been so laboriously constructed by morphologists of recent decades, in the face of almost all natural evidence, is here adopted.

The sixty-three pages devoted to histology, under the title "Inner morphology," is most creditable. The language is simple and exhibits that clearness which bespeaks familiarity, and the illustrations are excellent and well selected. The 132 pages devoted to classification of angiosperms yielding vegetable drugs does not justify its title. The families are enumerated in order, with the drugs pertaining to each, but by no stretch of courtesy can this be called a classification. The condensation of this matter, in immediate connection with the study of drugs in the second part, Pharmacognosy, would have been more natural from the student's standpoint, and really helpful, which now one finds great difficulty in admitting.

Nearly 400 pages are devoted to pharmacognosy, the application of the matter of the first part to the study of drugs. About one fourth of this space is taken up with the subject of powdered drugs. In this entire part, special means are employed to simplify the work of actual identification, and the general discussions and instructions for procedure are admirable.

Altogether, Professor Kraemer's book is probably the most comprehensive and valuable of its kind that has yet appeared.

H. H. Rusby

The Cambridge Natural History. Edited by S. F. Harmer and A. E. Shipley. Vol. I., including Protozoa, Porifera, Cœlenterata, Ctenophora and Echinodermata. Pp. 671, 296 figures. London: Macmillan & Co.; New York: The Macmillan Co. $4.25.

To have four very interesting groups of lower animals treated in one volume is to have none of them satisfactorily handled, and in the present volume of this important series we feel the limitations that have been set the various contributors. The different divisions are unevenly balanced as to both matter and substance, and in two of the divisions at least, the impression is gained that the author had

mainly a book knowledge of the group he was monographing.

The section on Protozoa written by Marcus Hartog has a great deal of interesting matter, and the various physiological activities of the unicellular animals, such as digestion, secretion, etc., and the relations of nucleus to cytoplasm and the like, are considered in a broad and suggestive way. The fact that the treatment in all such matters is strongly colored by this author's often unique ideas is only to say that it was written by Professor Hartog, and, although always interesting and on the surface convincing, the generalizations can not always be accepted. We meet again the time-worn discussion on spontaneous generation (gotten up apparently to controvert Bastian's recent outburst), and on animals and plants, but we do not find sufficient emphasis on the more important modern features that are characteristic of the protozoa, such as the physiological importance of the life cycle and the morphological importance of chromidia and nucleus.

The section on sponges by I. B. J. Sollas is not as well written as the other sections and the meaning is frequently hidden in obscurity of the construction. The classification adopted is that of W. J. Sollas and Bütschli, Minchin and Maas are followed in assigning the Porifera to the division Parazoa, apart from the other metazoa and from the protozoa. Morphology and relationships of the spicules are carefully worked out, but we find very little on sponge development. This section is full of matters of popular interest, examples of which are afforded by the suggestion of the therapeutic value of the common house sponge on account of its iodine, and a popular description of the origin of flint.

The account of the Cœlenterata and Ctenophora by S. J. Hickson is little more than a list of families and can scarcely be described as interesting reading. The monotony of almost straight taxonomy is broken a bit by a discussion of corals and coral islands, but the work for the most part is devoid of general interest. With all the valuable and biologically interesting data afforded by the cœlenterates we feel that Professor Hickson has lost here an opportunity to present a readable account of one of the most fascinating groups of invertebrates.

E. W. MacBride has given a much more general account of the Echinodermata, although here, too, a wealth of biological facts has scarcely been touched, while details of structure fill page after page. The group is taken up somewhat differently than is customary in that the Asteroidea are regarded as the most primitive of the echinoderms, while the Holothuroidea are considered as a continuation of the same line of development that led to the Echinoidea. Unlike the other contributors, MacBride has given more embryology, although his account of the development of an echinoderm taken by itself is not full enough to give a clear picture to one unfamiliar with the complicated metamorphosis of these forms.

We do not see why the Echinodermata should be included with the above lower groups of invertebrates unless it is a characteristic devotion to the tradition of Cuvier's Radiata, or indeed, mere expediency. Certainly it seems poor logic to speak of echinoderms as intermediate between cœlenterates and higher invertebrates (page 428) and then to point out the probable common ancestry of Echinodermata and Vertebrata through dipleurula and tornaria larvæ (page 617).

The volume is beautifully gotten up and has a wealth of tables and keys of classification and is invaluable to the student of animal taxonomy although disappointing here in that it will not carry him into genera and species.

G. N. C.

SCIENTIFIC JOURNALS AND ARTICLES

The Journal of Comparative Neurology and Psychology for May contains three papers. The first, "Concerning the Intelligence of Raccoons," by Professor L. W. Cole, is based upon the study of thoroughly domesticated animals which were reared in captivity. They are found to be more docile than cats and able to form much more complex associations, though they are inferior to monkeys. They do not imitate their fellows, but learn various

acts from being put through them. The experiments indicate the presence of mental images. Miss Isabel McCracken, in studying "The Egg-laying Apparatus in the Silkworm (*Bombyx mori*) as a Reflex Apparatus," performed various operations on the nervous system to learn the localization of function in the egg-laying reflexes. The posterior abdominal ganglion is the controlling center and exhibits a high degree of independent activity. The vitality of the silkworm moth, as measured by length of life and capacity of the reproductive system to function, is not impaired by removal of the head. The exact influence upon the reproductive function of the cerebral, thoracic and the several abdominal ganglia was experimentally determined. "A Study of the Choroid Plexus," by Walter J. Meek, adds confirmatory evidence to the conclusion that the plexuses are concerned in the secretion of the cerebro-spinal fluid.

SOCIETIES AND ACADEMIES

THE ST. LOUIS CHEMICAL SOCIETY

At the meeting of the St. Louis Chemical Society, held June 10, three papers were presented on the general subject "The Fixation of Atmospheric Nitrogen."

1. "By Plants," J. Arthur Harris, of the Missouri Botanical Gardens.

2. "By Direct Oxidation," Carl Hambuechen.

3. "As Ammonia and Cyanides," Dr. F. W. Frerichs.

The speakers presented the general history of the several processes, and the methods employed, together with an account of the present status of the subject. Dr. F. W. Frerichs concluded that even if the Chilean sources of combined nitrogen should be exhausted within twenty-five years, and even if the low nitrogen content of mineral coal (about 2 per cent.) excluded this as a source of combined nitrogen, except in the few cases in which this nitrogen can be obtained as a by-product, still, chemistry will be quite able to supply all the combined nitrogen that shall be required.

C. J. Borgmeyer,
Corresponding Secretary

DISCUSSION AND CORRESPONDENCE

DR. EASTMAN'S RECENT PAPERS ON THE KINSHIP OF THE ARTHRODIRES[1]

Every one who labors with the time-honored problem of vertebrate descent must consider, sooner or later, the arthrodiran "fishes," for these, with forms similar but even more puzzling, were the most conspicuous and diversified of earliest chordates. They are first known in the upper Silurian, run their gamut of evolutional prosperity in the middle Devonian, and become extinct in the early Carboniferous: the earlier forms were small with tubercle-like teeth, the later, often of considerable size, with many types of dentition, tubercular, trenchant, or crushing. Unhappily, however, the various forms of arthrodires are known only imperfectly, and the fact that various writers have considered them as related to almost every and widely separated groups of living fishes is enough to indicate how little is known of their anatomy.

Among the latest contributions to this unsatisfactory theme are three papers by Dr. C. R. Eastman, and these contain such reactionary views as to the kinship of arthrodires that they merit a somewhat extended review. For, in the matter of vertebrate descent, there should, I think, be entered a friendly protest against Eastman's conclusions—all the more necessary on account of his deservedly high authority in matters of palæichthyology—and the reasons should be summarized for regarding his arguments inadequate. On the other hand, I do not believe that this is the place to support in detail a rival theory—it is rather to show the intricacy of the materials involved and the limitations to which our conclusions must be subject.

Eastman brings out in his papers three essential theses. He aims to demonstrate: (1) That arthrodires are specialized lung-fishes, principally on the evidence of dental plates and

[1] "Dipnoan Affinities of Arthrodires," *Am. Jour. Sci.*, Vol. XXI., February, 1906. "Structure and Relations of Mylostoma," *Bull. Mus. Comp. Zool.*, Vol. L., No. I., pp. 1–34, pls. 1–5, May, 1906. "Mylostomid Dentition," *ibid.*, Vol. L., No. 7, pp. 211–229, 1 pl., February, 1907.

the arrangement of the bones of the head-roof. (2) That the living types of lung-fishes, particularly the Australian *Neoceratodus,* show the closest affinities with Devonian arthrodires—especially with *Mylostoma,* the form which has pavement-like dental plates. (3) And that he has discovered the way in which the dental plates of *Mylostoma* were originally arranged. These theses may now be examined; but for convenience, they will be taken up in an inverted order.

I. *As to the dental apparatus of Mylostoma.*

In various forms of arthrodires there were present at least three pairs of dental plates;—there was possibly a greater number of these plates, in pairs or azygous, but the proof is still imperfect. In the case of *Mylostoma,* the three pairs of plates occur in a single well-preserved specimen which was first described by the reviewer (*Mem. N. Y. Acad. Sci.,* 1901), who endeavored to show that these plates corresponded to the "pre-maxillary," "maxillary" and "mandibular" plates of other arthrodires, and that they were arranged in the mouth in a similar manner—the smallest plate, sharply triangular, becoming the "pre-maxillary," and the medium sized, ovoidal one, the "maxillary." In the fossil, moreover, the normal position of the plates in the mouth indicated, since two of the plates, "maxillary" and "premaxillary," are preserved side by side, in singularly perfect contact. These conditions, then, become the point of departure for Eastman's detailed studies, which involve, by the way, over two-score octavo pages. Thus: taking a large series of detached dental plates (which, we infer, may well have belonged to different individuals, species and probably even genera), Eastman places them together, *secundum artem,* until their grinding surfaces fit, and thus obtains their "true arrangement." By this mode of procedure, he first of all changes the relative position of the "maxillaries," as given by Dean, and figures a pair of new elements, "vomerines," lying crosswise in the front of the mouth. This arrangement, however, does not give permanent satisfaction to its author, for in his third paper, the vomerine plates are withdrawn from the complex, and in this process each of these elements is rotated 90°, changed sides, transferred from the upper to the lower jaw, and described as having belonged to a new mylostomid. This change, however, does not deter the author from still insisting upon the actuality of vomerine plates. On the evidence of a new arthrodire, *Dinomylostoma,* in which he describes three pairs of dental plates, he argues, again from their needs in fitting together, that there must have been still another (*i. e.,* a fourth) pair of plates. Indeed, he declares confidently that, "unacquainted though we be with actual specimens, the existence of vomerine teeth in *Mylostoma,* real or potential, is an assured fact"! That this may be so one will readily admit, but it is not quite obvious from Eastman's argument, especially when it entails the corollary that the two well-known pairs of upper dental plates of *Mylostoma* are the homologue of the single pair of "shear teeth" of a closely similar arthrodire (*Dinichthys*). For we can not understand why we should be asked to believe that two arthrodires, similar to each other in a host of characters, should be so distinct in this important particular? Nor does it make the argument quite convincing when Eastman points out that the "palatine" plate in the young lung-fish, *Neoceratodus,* passes through a stage in which it shows traces of subdivision (=a "*Mylostoma* stage"), for this implies a finished perfection of the embryological record, which would hardly have been assumed by even Haeckel in his palmiest days.

In short, I can not feel that the work of Eastman on mylostomid dental plates is convincing. He has not demonstrated that the plates in *Mylostoma* were more numerous than those well known in other arthrodires, nor has he modified satisfactorily our views as to their relative arrangement. The evidence of the first specimen, which shows two of the dental plates in closely fitted contact, is still, I believe, better evidence in the matter of mylostomid dentition than that obtained by elaborate fittings of detached and possibly (bear witness Eastman's "vomerines")

unrelated dental plates. The chances are infinitely small that in the fossil in question two such plates, if once separated, could have accidentally come to lie in such accurate apposition. And until more perfect material is forthcoming, the present specimen remains of paramount value, none the less so since, as the writer pointed out, the faceted surface of these combined plates corresponds to the indented area of the "mandibular," which is present in the same fossil and must have apposed them. By this view, also, the dentition of one arthrodire can best be explained in terms of another, the smaller, more irregular "premaxillary" of *Mylostoma* becoming the homologue of the smaller and more irregular "premaxillary" of *Dinichthys,* and the longer oblong "maxillary" to the long "shear tooth" of the latter form. It is not necessary, therefore, to go afield and postulate a closer affinity of the Devonian arthrodire *Mylostoma* to a recent lung-fish when a comparison can readily be made with a contemporary form (*Dinichthys*), to which in many regards it is closely akin.

II. *As to the very primitive characters of Ceratodus which ally it to Mylostoma and separate it widely from known Paleozoic Lung-fishes.*

Eastman expresses his view as to the relationship of lung-fishes and arthrodires thus: A primitive ceratodont (from which descend directly *Ceratodus* and *Neoceratodus*) was the progenitor of two side lines of fishes, one giving rise to more and more specialized lung-fishes, the other to more and more specialized arthrodires. Before the specialized line of lung-fishes became extinct it gave rise successively to such forms as *Dipterus, Scaumenacia, Phaneropleuron, Uronemus* and *Ctenodus:* before the arthrodire line died out it passed through phases represented in the order *Macropetalichthys, Homosteus, Mylostoma, Dinomylostoma, Coccosteus, Dinichthys, Titanichthys.* The fact that in all of the mass of Paleozoic lung-fishes there is not a suggestion of the hypothetical *Ceratodus* is easily waived aside as due to the imperfection of the geological record. And thus are rejected Dollo's illuminating researches as to the descent of the dipnoans.

We may query, accordingly, the reasons why the modern *Ceratodus* (*Neoceratodus*) is assumed to be the primitive dipnoan—to say nothing, for the present, of its kinship to the arthrodira. And here Eastman's studies do not appear adequate: *Ceratodus,* he points out, has a cutting type of dental plates, it has a diphycercal tail (rather than heterocercal), and it has fewer dermal head-plates. He does not suggest, however, that we have at the present time a fairly rich material of fossil dipnoans, and he fails to indicate that in the ceratodonts many characters common to the early forms do not appear; in a word, Eastman does not explain clearly his paradox—that we are to believe that these earliest dipnoan characters should be regarded as more modified than the structures of the modern *Neoceratodus.* Indeed, the skeptical reader remembers, on the contrary, that in the earlier fishes the teeth are in the form of tubercles, more or less shagreen-like in form and arrangement; that in all the earliest groups of true fishes, sharks, dipnoans, crossopterygians, actinopterygians, there occur no shear-like dental plates; that in the series of definitely known lung-fishes beginning with those in the Devonian, the tubercular teeth are reduced gradually, and that only with the development of their basal supports do there come to be formed cutting dental plates. Moreover, that this mode of evolution is the true one is confirmed with singular clearness in the general plan of the development of the teeth of *Neoceratodus* itself—a great number of tubercular denticles preceding the solidification of their basal supports and the growth of bony cutting ridges. In short, there is every reason to conclude that the dental plates of *Ceratodus* are derived from dental plates of dipnoans of the paleozoic type, and there is no tangible evidence that the dental plates of the recent dipnoan picture the ancestral condition.

Again, who can doubt that the descent lines of the dipnoans and the ganoids converge very closely in the earlier paleozoic times? One

may even be doubtful whether certain of these genera were ganoids rather than lung-fishes, and close examination of the known structures of these forms has led every observer, as far as I am aware, to postulate the closest kinship between the two groups. From these early types, upward, one may trace in the fossil lung-fishes the dermal plates of the head-roof becoming less numerous, lighter in texture, and deeper in position, losing completely their primitive tubercle-studded surface. From *Ceratodus* (as Teller's figures indicate) to *Neoceratodus* there is a marked step in this direction, and from such a condition only can one understand the curiously reduced dermal head-roof of *Protopterus* and *Lepidosiren*. Why, accordingly, should we believe, in the face of this kind of evidence, that the condition of the head-roof of *Ceratodus* is more primitive than that of the early ganoids and dipnoans conjoined? There is certainly adduced no concrete evidence for such a reactionary view. Eastman's final evidence as to the ancestral nature of *Neoceratodus*, as far as I am able to find, is in the shape of its caudal fin: it is diphycercal rather than heterocercal. Dollo has shown, on the other hand, that the earliest dipnoans (ganoids and sharks as well) are heterocercal, and that it was only through the paleontological series, which he carefully depicts, that diphycercy was attained in the modern lung-fishes, as an eel-like adaptation to living in a muddy bottom—an evolution in the process of which the dorsal and anal fins became merged with the caudal. This conclusion of Dollo is based upon such strong testimony that it can hardly be disproved merely by the assumption that *à priori* a diphycercal caudal fin is more primitive than a heterocercal one! In short, we can find in Eastman's studies no ground for making the stock of *Neoceratodus* an ancestral one; there is, indeed, no reason evident why it should not have descended from an ancestor resembling *Uronemus* or *Phaneropleuron*.

III. *Mylostoma as a Primitive Arthrodire, related to a Ceratodont Lung-fish.*

Mylostoma differed little from its contemporary arthrodires. In its gnathal plates, however, it had evolved restricted crushing surfaces instead of the long tubercle-studded jaw-rims of *Diplognathus, Trachosteus, Selenosteus* or *Coccosteus*. *Dinichthys,* indeed, shows transitional characters, for the tubercles of the anterior reaches of the jaws are ground away when the jaws attain a shear-like action, and the gnathals of *Dinomylostoma* show a still nearer approach to the pavement-like surfaces of *Mylostoma*. In short, there is evidence that the arthrodira during their extraordinary evolution gave rise to a series of forms whose dental characters ranged from tuberculate to pavement-like—a line of evolution which, it will be recalled, is paralleled in other groups of fishes—sharks, ganoids, teleosts, and, as above noted, dipnoi. Now since the time of the classical studies of O. Hertwig (1876) on the origin of the bony plates of fishes, there has been found no good reason to doubt that the tuberculate condition was the ancestral one, and it follows, therefore, that until strong reasons to the contrary be adduced, we can safely assume that the same law of development holds true in the case of the arthrodira. That is to say, that the crushing plates of *Mylostoma* are secondary, not primitive. Eastman, however, contends that since *Mylostoma* resembles *Ceratodus,* it is therefore primitive. But if, as we have indicated above, there is little reason to regard *Ceratodus* as primitive, it is clear that the affinities of *Mylostoma* must be determined by comparison with kindred arthrodira. It might be pointed out, finally, that the great majority (possibly eight out of ten) of the genera of which jaw plates are known, bear tuberculated dental plates, including the earliest known arthrodires. And this is naturally interpreted in favor of the modified nature of *Mylostoma,* for thus historical evidence supports the findings of comparative anatomy.

If, now, the foregoing objections to Eastman's conclusions are valid, it is quite clear that the general question of the affinities of the arthrodira is just as doubtful as ever. Eastman, emphasizing the dipnoan characters

of the arthrodira, points out similarities in *dental plates,* but these might ally them as well to chimæroids as to dipnoi—in the *shape of the caudal fin* and its supports, which are scarcely more dipnoan than shark-like (pleuracanth) or ganoidean—in *persistent notochord,* which might be as well shark-like, dipnoan or chimæroid,—in *punctation of dental plates,* which is a character by no means exclusively dipnoan. So that one may, I feel, hardly conclude with Eastman that the lung-fish (*Neoceratodus*) recalls "in its entire organization, save for the absence of dermal trunk-armoring, the principal features of the arthrodires," or that there are present between the modern lung-fish and the ancient arthrodire, "such intimate structural resemblances [that they] can not be explained by parallelism but point plainly to common descent." Eastman is willing to admit, on the other hand, that the evidence is questionable that arthrodires had a vestige of ventral limbs, and that they are unlike dipnoans in possessing a shoulder- and ventral-armoring. But even if we can picture such a *paleozoic descendant* of primitive lung-fishes, can we still imagine one which lacks also pectoral limbs, and opercular bones, and which possessed on the other hand shoulder joints rendering possible a curious dorso-ventral movement of the head?[2] Certain it is that the resurrected doctrine of the kinship of arthrodira and lung-fishes finds little support in the recent studies of Hussakof and others, which have shown that the gap between the arthrodira and the pterichthyids is by no means as wide as we have hitherto taught.

Bashford Dean
Columbia University

[2] Eastman can answer these objections only by minimizing their value, as when he maintains that the operculum is represented in the rudimentary spine of *Dinichthys,* and that the movable attachment of the rib to the cranium in *Neoceratodus* is comparable to the intermovement of head and trunk in the arthrodira. In his comparison of the gnathals of arthrodira with the splenial of dipnoans, he calls attention to a fleck of cartilage fossilized on the outer (*ectal*) face of a gnathal of *Dinomylostoma* as evidence of its attachment to a meckelian cartilage; but this evidence, even if accepted, would be as readily ganoidean as dipnoan. It may be remarked, however, that the structure in question is too obscure to warrant a definite judgment as to its nature, and the fact that the ectal surface of such a plate is sometimes known to bear tubercles quite like those of the usual head plates does not make the assumption probable that the gnathal plates were placed far from the surface of the head.

EVOLUTION THEORIES: STATIC, DETERMINANT, KINETIC

In Science for December 7, 1906, Dr. Ortmann presents another of his series of reports upon the kinetic conception of evolutionary processes. It is very gratifying, of course, that my suggestions are receiving so much valuable time and attention, and the more to be regretted that unfortunate methods of study still interfere with the success of so persistent an inquiry.

Would it not be better, for example, to simplify the issues by omitting the discussion of the novelty or antiquity of the ideas, or at least by postponing it until the ideas themselves have been clearly perceived? It will then become evident to Dr. Ortmann that Darwin and many others have entertained kinetic views of evolution, though not bringing them to the point of definite formulation.

In estimating the value of an interpretation which differs from our own it is well to suspend or lay aside temporarily the opinions we have been entertaining, in order to see how the alternative theory accommodates the facts. But instead of making a personal inspection of the kinetic premises, Dr. Ortmann ties himself fast by italics of certitude to his static dogma: "*If the environment remains uniform, perfect uniformity of individuals will result.*" This keeps him far outside of the subject upon which he continues to inform the readers of Science.

Viewed at the long range imposed by this fictitious barrier, many things look quite the same which would be found very different on closer inspection. Thus it appears to Dr. Ortmann that symbasis is the same as amphimixis, whereas the two processes are on distinct lines and work in different directions.

Amphimixis occurs when variations originated under conditions of narrow breeding are brought again into more normal relations of broad-breeding, or into renewed contact with the unrestricted descent of the species at large. Mutative variations are often obliterated by cross-breeding, and replaced by the normal characteristics of the wild type. Amphimixis means that narrow varietal strands can be retracted and reincorporated into the specific network.

Symbasis is the free interbreeding of the normally diverse members of a species, which brings about the coherent evolutionary progress of the whole network of descent. Symbasis keeps the procession moving, while amphimixis rescues the stragglers from the side-paths. Amphimixis corrects abnormal diversity induced by narrow breeding, but does not interfere with normal diversity, nor with evolution, and only appears to do so when the degenerative mutations of narrow-bred organisms are looked upon as genuine examples of evolution.

The static assumption is that the species remains uniform and stationary until acted upon by some agency which is external, or at least intermittent. This was a very natural assumption to make in the early days of evolution because it involved the least possible modification of the earlier theory that each species was the product of a definite creative act. Under the static theory the species could still be held to be ideally uniform. Evolution could be charged to the environment, which was known to be able to influence the development of individual organisms, and could therefore be thought of as influencing whole species. This idea of definitely directed variation has been called *mutation* by Waagen and *orthogenesis* by Eimer. The formation of new species by discontinuous or saltatory variations has also been called *mutation* by de Vries.

All these conceptions are static, like the Darwinian theory of natural selection. They do not permit us to pass beyond the barrier of ideal uniformity and stability, and forbid us to find causes of evolution in anything except environmental influences. Dr. Ortmann's reasoning on the immanence of environmental causes appears to be entirely logical, but it can convince only those who disregard the facts of nature and accept the static assumption as the basis of inference.

The second alternative conception of evolution was that of Naegeli, who believed that evolutionary causes might reside in the protoplasm itself, and who worked out a theory of protoplasmic structure which would provide for systems of changes in definite directions. This excited the 'hereditary mechanism' speculations of Weismann and his successors, which continue to the present day, though it has been usual to invoke environmental causes to change the workings of the 'hereditary mechanisms' and to cause them to yield new forms, which are supposed to be preserved by selective or other isolation.

The kinetic theory differs from its predecessors in recognizing that evolution is neither initiated nor actuated by the environment. Variations appear without environmental causation and are preserved and accumulated in the species by prepotency, instead of by isolation. Isolation and narrow breeding bring the degeneration which amphimixis cures, but inside the normal network of descent individuals are diverse and new variations are prepotent. Symbasis weaves the diversities and the new characters together in endlessly varying proportions, and in this way conducts a constructive, coherent evolution, a gradual advance of the whole network of descent of the species.

Such evolution Dr. Ortmann declares to be incomprehensible, and so it may appear from his static point of view. But the difficulty can be surmounted if he will take the italics out of his *ipse dixit* of uniformity and allow himself to become acquainted with the phenomena of heterism, the contemporaneous non-environmental differences which everywhere exist among the members of species, and even among the simultaneous offspring of the same parents. The normal diversity and free interbreeding by which evolutionary motion can be accomplished are concrete and

well established facts, while the ideal of stable uniformity under changeless conditions remains a pure speculation.

O. F. Cook

Washington,
December 19, 1906

SPECIAL ARTICLES

IONIZATION IN CLOSED VESSELS

In connection with some other work on the ionization in closed vessels it was found necessary to examine the daily variation of this ionization, to find what parts of the day it is most constant and to find the best methods to get as constant an ionization as possible. Soon after the work was started the article of Wood and Campbell on the 'Diurnal Periodicity of the Spontaneous Ionization of Air and other Gases in Closed Vessels' appeared.[1] It was thought that it would be of interest to find the periods of maxima and minima in Baltimore.

Dike[2] has also found a similar periodicity in the amount of radio-active emanation in the atmosphere and his periods agree quite well with the periods as found for the ionization in closed vessels. It would thus seem that the variation of the ionization in closed vessels was due to a variation in the penetrating radiation and that by screening this off by the use of thick lead plates one ought to get a much more constant ionization.

The ionization was measured by means of an iron electroscope 10 x 13 x 20 cm. in size. The charged electrode was bent into the arc of a circle and over this arc the gold leaf fell as the charge leaked off. The electrode was charged across a small air gap and so was air-tight. All parts except the charged electrode were earthed. The position of the gold leaf was read by means of a micrometer microscope, the cross hairs moving in the eyepiece. As the microscope was firmly clamped, the same portion of path traversed by the gold leaf would be always used. The air was enclosed some twenty days before readings were taken. The electroscope was not allowed to become entirely discharged at any time.

An electroscope similar to the above but smaller in size was also used. The readings were made in a tower room on the fifth floor of the physics laboratory. The room was not heated artificially, so that the temperature remained fairly constant. All sunlight was screened off.

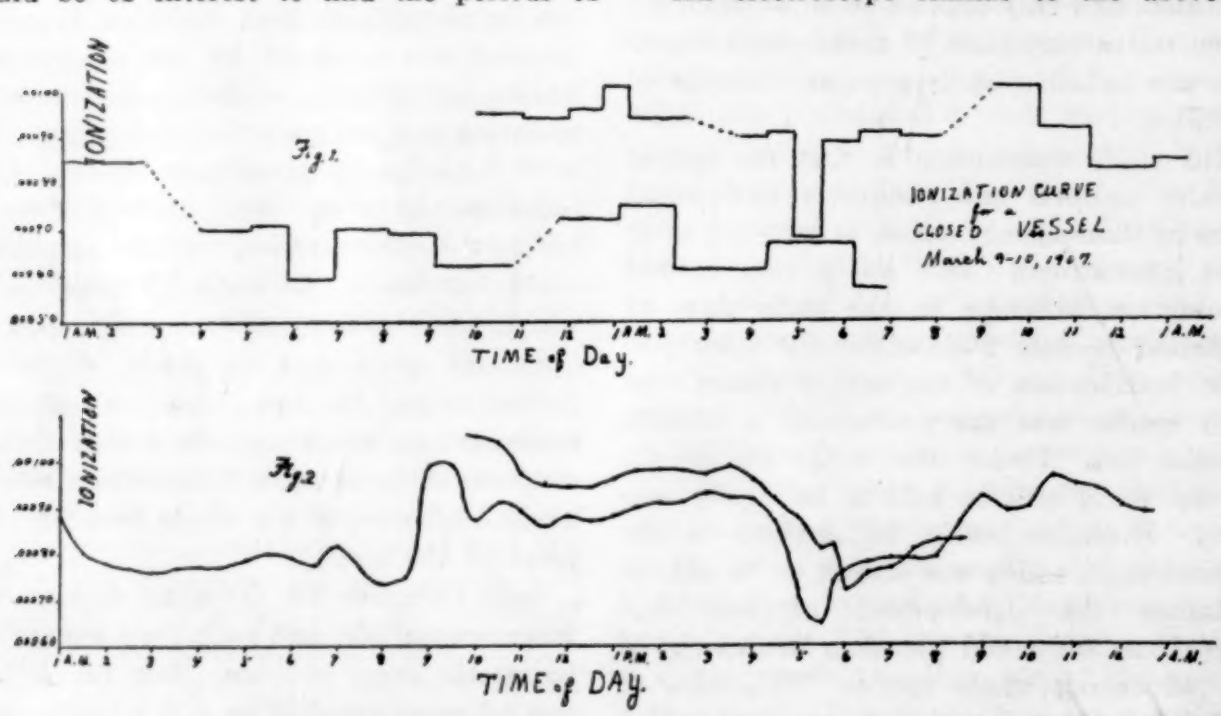

Fig. 1 represents the ionization for March 9–10, 1907. About midnight it began to snow. It will be seen that the value of ioniza-

[1] *Phil. Mag.*, Feb., 1907.
[2] *Terr. Mag.*, Vol. XI., No. 3, p. 128.

tion falls very considerably. It will also be noticed that the relative minimum drop on March 10 is not nearly as large as on March 9. The dotted portions of the curve represent the times when the electroscope was recharged. That all parts of the scale were equally sensitive was shown afterwards when a lead screen was placed around the electroscope. The rate of fall of the gold leaf was then practically constant for the portion of path used. During the day there was a great deal of vibration due to travel on the cobblestone street next the building, so that the error of reading was larger.

Fig. 2 represents the ionization for several days in February and March of the present year. (*a*) is the average of readings for four days and (*b*) for fifteen days. These and other curves show maxima for February and March at about 9 A.M. and 10 P.M., and minima at about 7 A.M. and 6 P.M. Very few observations have as yet been made on the 7 A.M. and 9 A.M. periods. The most conspicuous is the minimum at 6 P.M. This occurs with considerable regularity and is very marked, the ionization often falling thirty or forty per cent. No corresponding change of temperature or barometric pressure was noticed. It will be noticed in the following table, however, that it never drops below the value of the ionization when the penetrating radiation is cut off. It has been found that sudden changes of temperature produce air currents and set the gold leaf in motion, but it hardly seems likely that this minimum is to be explained in this way. Still it seems very remarkable that the penetrating radiation should have such a marked drop and the problem as to whether it is a temperature effect is to be taken up.

The electroscope was then screened with lead plates from 4 to 5 cm. thick. A window was necessary to make the readings, however, so that the radiation was not all screened out. The rate of leak was made much more constant. The marked minimum at 6 P.M. was usually not noticeable.

The following table gives the average ionization for several days. Readings were usually taken from 10 A.M. till 6 P.M. The period of minimum is not included in the column marked average ionization. The ionization during the early part of the afternoon was found fairly constant.

Date	Weather	Average Barometric Pressure	Ionization	Minimum Ionization	Time of Minimum
Feb.					P.M.
16	Clear.		.00113	.00077	5.40–6.00
18	"		.00085	.00064	5.30–7.00
19	Cloudy.		.00100	.00078	5.00–6.00
20	"		.00100	.00092	5.00–7.00
21			.00102	.00069	5.00–5.30
22	Clear.	77.10	.00101	.00058	4.30–5.30
23		77.80	.00093	.00056	5.30–6.00
25	Clear (8″ snow)	76.25	.00090	.00051	5.30–6.00
Mar.					
3		76.50	.00088	.00078	6.00–7.00
4	Clear.	76.50	.00060		
5	"	76.50	.00075		
Apr.					
15	Clear. Lead screen put around telescope.	75.50	.00049	No drop observed.	
16	Cloudy.	75.20	.00051		
17	"	75.70	.00052		
18	Clear.	75.90	.00052		
30	Cloudy.	75.80	.00051		

In conclusion the writer wishes to express his thanks to Professor Ames for his many kindnesses and to Professors Rutherford and Dike for their suggestions.

W. W. STRONG

LABORATORY APPARATUS FOR MEASUREMENT OF THE FORCE ON A CURRENT-CARRYING CONDUCTOR LYING IN A MAGNETIC FIELD

THE method used by Ampère in his investigations of the effect of a magnetic field on a current-carrying conductor was to arrange the conductor so that the forces acting on one part of the circuit just balanced those acting on another part. From observations thus made and without the direct measurement of any forces in force units, Ampère established his propositions with regard to the mutual action of current-carrying conductors.

From these propositions is derived the expression for the force acting on a straight conductor lying in a uniform magnetic field. This is a very special application, but it is

perhaps the most common one. Ampère's laws give as the equation for the force, F, acting on a conductor of length l centimeters lying at right angles to a field of intensity f,

$$F = ilf.$$

The lack of any simple means of measuring directly the force acting on the conductor in this case led to the construction of the apparatus herein described.

The apparatus also serves well to illustrate the basis on which we construct our definition of the absolute electromagnetic unit of current.

On account of the smallness of the strength of the earth's field, either a very large current must be used with it, to produce an effect of convenient magnitude to measure, or else delicate means of measurement must be employed. To avoid these difficulties, a field is obtained by using a C-shaped cast-iron cylinder as the core of an electromagnet. The length of the cylinder used is 9.5 cm.; its inside diameter, 7.7 cm.; and its outside diameter, 11.4 cm. The width of the air gap is 4.0 mm. The magnetizing coil has 400 turns of number 20 copper wire.

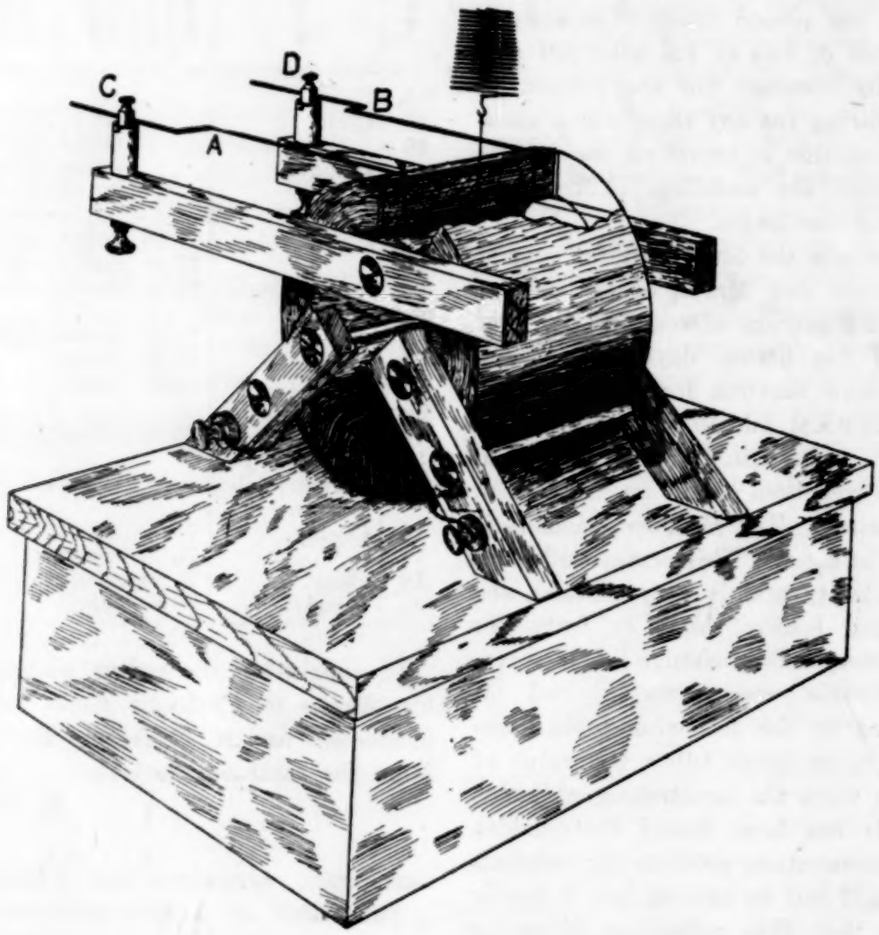

Fig. 1.

The method of mounting the electromagnet and conductor is shown in Fig. 1. The conductor AB, which lies in the air gap is bent up, then back, and clamped in two binding posts, C and D, through which steel pins are driven. The lower ends of these posts dip into mercury cups. The steel pins form a free axis of rotation.

The force acting on the conductor is measured by the elongation produced in the spring of a balance of the Linebarger type. In

taking the observations given below, the magnetizing current and the current in the conductor were measured with two Weston portable ammeters.

Observations were first taken to show that when the field is constant, the force on a given conductor is proportional to the current flowing through it. In taking the observations given in Table I., a wire extending through the slot, then bent straight back and clamped in the binding posts was used. The conductor was therefore not in a uniform field. The table gives the first set of observations taken.

TABLE I.

Current in Conductor	Zero Reading of Balance	Elongation Reading	Elongation	Elongation Current
amperes	cm.	cm.	cm.	
2.045	9.79	16.97	7.18	3.52
2.560	9.75	18.81	9.06	3.54
3.065	9.77	20.63	10.86	3.54
3.560	9.74	22.41	12.67	3.56
4.045	9.80	24.11	14.31	3.54
4.465	9.76	25.80	16.04	3.60
5.000	9.76	27.44	17.68	3.53

Steady current in magnetizing coil, 0.798 amperes.

In taking the next set of observations, Table II., the length of the conductor, as well as the current in it, was varied. To obtain these results, wires of the form shown in Fig. 1 were used. The length of the horizontal part of the wire lying in the slot and measured from center to center of the turned-up ends, was used as the length of the conductor. That this is the "effective" length of the conductor, if Ampere's law is true, may be shown below.

If the force acting on a straight conductor is ilf, then the force acting on an element of the conductor, of length dx, at the bend of the conductor will be equal to the product of four factors, the area of the section of the conductor to the right of dx, the current per unit area, the intensity of the field, and the length dx. Assuming that the current is uniformly distributed throughout the conductor before it reaches the turn and that it becomes uniformly distributed after it passes the turn and before it leaves the air gap, we obtain as the expression for the vertical force acting

TABLE II.

Length of Conductor (l)	Current in Conductor (i)	Zero of Balance	Elongation Reading	Elongation (E)	E/l
cm.	amp.			cm.	
7.70	2.960	3.81	11.97	8.16	0.358
	4.140	4.02	15.36	11.34	0.355
	4.900	4.03	17.48	13.45	0.357
	2.145	4.07	9.93	5.86	0.354
					0.3560
6.06	2.150	7.52	12.10	4.58	0.351
	3.215	7.60	14.48	6.88	0.353
	4.150	7.60	16.46	8.86	0.352
	4.875	7.62	18.00	10.38	0.351
					0.3518
4.96	2.175	6.79	10.57	3.78	0.356
	3.220	6.73	12.44	5.71	0.354
	4.170	6.77	14.14	7.37	0.358
	4.935	6.77	15.44	8.67	0.354
					0.3555

Steady current in magnetizing coil, 0.800 amperes.

on that part of the conductor to the right of the section AB, Fig. 2,

$$\frac{if}{\pi r^2}\int_0^{2r}(\pi r^2 - \int_0^x 2y\,dx)\,dx,$$

where r is the radius of the conductor. Integration of this expression gives ifr as the

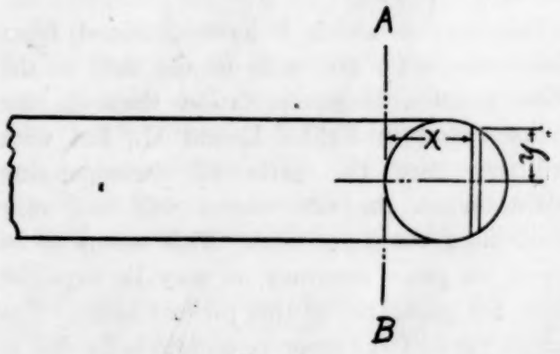

FIG. 2.

force acting on that part of the conductor to the right of AB, or r as the length to be added to the straight part of the conductor.

The third factor in the expression for the force on the conductor is f, the intensity of the magnetic field. This apparatus can be used conveniently for showing the relation between the force and f if a curve is plotted showing the relation between f and the cur-

rent in the magnetizing coil. To obtain such a curve, a coil, wound on a thin rectangular bobbin which could be slipped into the air gap of the electromagnet, was connected to a ballistic galvanometer. The deflections of the galvanometer when the coil is quickly withdrawn from the air gap being proportional to f, the required curve can be obtained by using such deflections and the corresponding magnetizing currents as coordinates.

The curve obtained will depend on the magnetic history of the ring. If the curve is to be of any use, the initial condition of the iron must be one that can be reproduced. The ring may be entirely demagnetized initially or it may be in the condition in which it is left when a certain fixed magnetizing current has been passed through it. This current should be large enough to magnetize the core quite strongly.

Another curve can be plotted showing the relation between the magnetizing current and the force on the conductor, the current in the conductor and the length of the conductor being constant. If these two curves be plotted to the same axes, it will readily appear that the force is proportional to the intensity of the field.

The results which I have obtained from these curves for the ratio of the field to the force show a larger variation than do the ratios found in Tables I. and II., but with ordinary care the ratio of corresponding ordinates on the two curves will not vary more than three per cent. This seems to be about as great accuracy as may be expected with the apparatus in this present form. The larger part of the error is undoubtedly due to the uncertain variations in the magnetic field.

The apparatus as here described was designed for the use of students of general physics. Its special advantage is the directness with which the force is obtained in terms of quantities already familiar to the student.

R. A. Porter

Syracuse University,
March 5, 1907

QUOTATIONS

THE NEW ENGLAND COLLEGE

Some of the New England college presidents are practically facing the question whether they should not voluntarily limit the number of their students. Within the last ten years, Dartmouth, for example, has nearly doubled in size—an increase due largely to the success of its professional and technical departments. President Hopkins of Williams favors the idea of limitation in the smaller colleges; and there is much to be said for his view, provided that the income of the corporation is sufficient to support an efficient faculty. In colleges like Amherst, Bowdoin, and Williams a first-class education can now be had, even as at the large universities. But there comes a point in the development of a college when the increase in students entails an expenditure out of proportion to the gains by tuition fees. The number of instructors has to be multiplied, and there must be a greater outlay for lecture-rooms and laboratories. Many of the smaller colleges would be helped if the craze for mere numbers could be checked. The energies of the professors could then be concentrated on the instruction of their relatively small classes, they could insist on a higher standard of scholarship, and possibly make the B.A. mean as much as a degree in technology.—*The N. Y. Evening Post.*

NOTES ON ORGANIC CHEMISTRY

ANHYDROUS SULPHOCYANIC ACID

Although numerous salts of sulphocyanic (thiocyanic) acid, HSCN, are known, and some of them are of considerable technical importance, the free acid has, hitherto, never been obtained in a state of purity. Wöhler believed that he had prepared it and Liebig stated that it decomposed with extreme ease. In 1887 P. Klason distilled the aqueous acid and passed the vapor over calcium chloride, heated to 40°, the unabsorbed material was condensed at a low temperature and was thought to consist of the anhydrous sulphocyanic acid, but A. Rosenheim and R. Levy[1] have recently shown that although Klason's

[1] *Ber. d. chem. Ges.*, **40**, 2166 (1907).

preparations occasionally contained as much as 40–50 per cent. of the acid, the remainder consisted of liquefied hydrogen sulphide, sulphur dioxide, carbon disulphide and hydrogen cyanide. The two chemists mentioned give the following description of the preparation of the chemically pure acid: Powdered potassium sulphocyanate, which has been fused until free from water, is mixed with an equal weight of phosphorus pentoxide in a distillation flask, connected with a receiver which is cooled in a mixture of ice and salt. The air in the flask is displaced by purified hydrogen under 40–60 mm. pressure. Concentrated sulphuric acid is now added gradually to the mixture in the flask, which is immersed in ice-water. The pure sulphocyanic acid collects in the receiver as a mass of white, dry crystals. At 0° it may be retained several hours in a closed vessel. It melts about 5°, and the liquid, in a few minutes, becomes deep red and then quickly solidifies, forming slender yellow needles; heat is evolved simultaneously. At 0° the acid dissolves in water almost without decomposition, but at the ordinary temperature polymerization products are formed. The acid has a sharp caustic odor and it rapidly attacks the skin.

J. BISHOP TINGLE

McMASTER UNIVERSITY,
TORONTO, CANADA

GEOLOGIC WORK ON THE COASTAL PLAIN

THE active cooperation of the States of the Atlantic and Gulf coasts, from the mouth of the Potomac to the Mississippi is enlisted in an investigation for which preparations are under way at the United States Geological Survey.

A systematic study is to be made of the age, character, and general relations of the rocks of the Coastal Plain, special effort being made to determine the position and extent of beds of economic interest, including water-bearing beds, phosphate deposits, fuller's earth, and other materials.

The general plan of the investigation was formulated at Washington on the first of January, 1907, at a conference invited by the Director of the National Survey and participated in by state geologists Kummel of New Jersey, Clark of Maryland, Watson of Virginia, Pratt of North Carolina, Yeates of Georgia, Smith of Alabama, and Crider of Mississippi, the heads of the survey's geologic and water resources branches, and M. L. Fuller and T. W. Stanton, also of the National organization.

At this conference the work that had already been done was discussed and arrangements were made for one of the most extensive cooperative investigations ever undertaken by the Geological Survey. The discussion brought out the fact that the work in New Jersey and Maryland had been completed under the auspices of the states, while that in Alabama is far advanced. The Geological Surveys of North Carolina, Georgia, Alabama and Mississippi have also done considerable work in the Coastal Plain region, and reports on the water resources of Georgia and Alabama have been published by the state bureaus. The work of the National Survey in this area has been confined to investigations of underground water problems in Virginia and North Carolina and to studies of the phosphate deposits of Florida.

If present plans are carried out field work in Virginia, North Carolina, South Carolina, and Florida will be completed during 1907, and that in Georgia, Alabama and Mississippi will be reserved for 1908. It is expected that the entire investigation will be completed and a final report submitted for publication in 1909.

General supervision of the work rests with a board of which W. B. Clark, of the Maryland Survey, is chairman and which includes the chiefs of the geologic and water resources branches of the National Survey and the state geologists of the interested states. The field work, which will be directed by M. L. Fuller, will be done chiefly by members of the United States Geological Survey, but state representatives will also be employed in North Carolina, Georgia, Alabama and Mississippi. The necessary paleontologic work will be directed by T. W. Stanton.

CINDER CONE NATIONAL MONUMENT

The President of the United States has issued a proclamation as follows:

"Whereas, the elevation in the State of California, within the Lassen Peak National Forest, known as 'Cinder Cone,' and the adjacent area embracing a lava field and Snag Lake and Lake Bidwell, comprising chiefly public lands, are of great scientific interest, as illustrations of volcanic activity which are of special importance in tracing the history of the volcanic phenomena of that vicinity;

"And whereas, it is provided by section two of the act of congress, approved June eighth, nineteen hundred and six, entitled, 'An act for the preservation of American antiquities,' 'That the President of the United States is hereby authorized, in his discretion, to declare by public proclamation historic landmarks, historic and prehistoric structures, and other objects of historic or scientific interest that are situated upon the lands owned or controlled by the government of the United States to be national monuments, and may reserve as a part thereof parcels of land, the limits of which in all cases shall be confined to the smallest area compatible with the proper care and management of the objects to be protected';

"Now, therefore, I, Theodore Roosevelt, President of the United States of America, by virtue of the power in me vested by section two of the aforesaid act of congress, do proclaim that there are hereby reserved from appropriation and use of all kinds under all of the public land laws, subject to all prior valid adverse claims, and set apart as a national monument, all the tracts of land, in the State of California, shown as the Cinder Cone National Monument on the diagram forming a part hereof.

"The reservation made by this proclamation is not intended to prevent the use of the lands for forest purposes under the proclamation establishing the Lassen Peak National Forest, but so far as the two reservations are consistent they are equally effective. In all respects in which they may be inconsistent the national monument hereby established shall be the dominant reservation.

"Warning is hereby given to all unauthorized persons not to appropriate, injure or destroy any feature of this national monument or to locate or settle upon any of the lands reserved by this proclamation."

AN INTERNATIONAL COMMISSION ON SLEEPING SICKNESS

At the invitation of the Colonial Office, Reuter's Agency reports, an important conference of the various African colonies and protectorates interested has been summoned to discuss concerted international measures for dealing with the terrible scourge of sleeping sickness, a disease which has decimated the natives in large areas of the Congo Free State, has proved fatal in the case of 200,000 natives in Uganda, has invaded French Congo and the Portuguese possessions, has appeared in the Sudan, and is now threatening German East Africa, Rhodesia and British Central Africa.

This conference met at the Foreign Office for the first time at the end of June, government delegates being present from Germany, Congo Free State, France, Great Britain, Portugal and the Sudan.

The delegates are as follows:

Germany—Herr von Jacobs, of the Imperial Colonial Office, Dr. Ehrlich and Dr. Fulleborn.

Congo Free State—Colonel Lantonnais, vice-governor general, Commandant Tonneau, M. Rutten and Dr. van Campenhout.

France—Dr. Kermorgant, Dr. Paul Gouzion, Professor Blanchard and Dr. Laveran.

Great Britain—Lord Fitzmaurice, who has been elected president, Sir W. Foster, Mr. A. W. Clarke (Foreign Office), Mr. H. J. Read (Colonial Office) and Sir Patrick Manson.

Portugal—Dr. Correa Pinto.

Sudan—Colonel Hunter and Dr. Balfour, of the Gordon College, Khartum.

The work before the conference includes the question of the holding of regular conferences, the establishment of a central bureau of information, and the assignment of definite points for investigation to particular countries or individuals.

In the case of Uganda, Mr. Hesketh Bell, his Majesty's Commissioner for the Protectorate, has prepared a scheme for dealing with the scourge in his Protectorate. The main features of the scheme are the deportation of the population from the infected lake shore and the segregation of the sick in a number of large camps, where they can be treated by atoxyl or other drugs which give hope for success.

THE INTERNATIONAL ASSOCIATION OF ACADEMIES

THE International Association of Academies, which met at Vienna at the end of May, will hold its next meeting three years hence in Rome, under the auspices of the Academia dei Lincei. We learn from the London *Times* that among the decisions taken was a resolution to codify the rules of procedure of the association. The issue of a complete and authentic edition of the works of Leibnitz was agreed upon, both the mathematical and the philosophical departments of the association recognizing its desirability. Progress less marked was made in regard to the interchange on loan of manuscripts between libraries, but the question was fully discussed and a small international committee chosen to deal with it pending the next meeting.

Some advance was also made in regard to the publication of the projected standard edition of the Mahabharata, while progress was reported in the preparation of the Encyclopædia of Islam, of which Professor de Goeje, of Leyden, laid before the meeting the first section in three languages—English, French and German. General satisfaction was expressed by the delegates at Mr. John Morley's action in granting, on behalf of the India Office, £200 a year for the next ten years as a contribution towards the cost of the work. The Belgian government has announced its intention of subsidizing the scheme for an international bibliography of historical and philosophical subjects, and it is hoped that support will also be forthcoming from England and America. The proposal that the association should choose an international auxiliary language, such as Esperanto, for use in the communications between members was negatived by 12 votes to 8. France and England voted with the majority. Austria accepted the principle of an auxiliary language, but would have opposed the choice of Esperanto, on the ground that it is not a scientific medium of communication.

ADDRESS ON THE OCCASION OF THE DEDICATION OF THE LINNÆAN BRIDGE[1]

THE recognition of the work of famous men is one of the happiest duties of mankind. It stimulates our endeavors and encourages us to make efforts which we would probably not make without their examples before us.

To-day we do homage to a distinguished man of science, and the unanimity with which the scientific societies and institutions of the City of New York join in this tribute is in itself evidence of the value which is placed upon his contributions to natural history.

Science has made great progress during the two centuries which have elapsed since the birth of Linnæus. Theories have in large part given place to ascertained facts or have been replaced by other theories based on more accurate knowledge of natural objects and of natural phenomena. The contributions of science to the welfare, comfort and happiness of mankind have made present human life widely different from that of two hundred years ago, and this amelioration of our condition, and the more general diffusion of knowledge has been accompanied by a vast improvement in morality.

The ceremonies of to-day are worthy of the great naturalist whose birth they commemorate. Societies and institutions all over the world join with us in honoring him, and are represented here by delegates or have transmitted documents expressing their appreciation of his life and labors. The public natural science institutions of New York have come to take leading parts in the subjects

[1] Delivered at the dedication to Linnæus of the Pelham Parkway Bridge over the Bronx River, by Nathaniel Lord Britton, President of the New York Academy of Sciences, May 23, 1907.

they teach and illustrate. Public and private philanthropy have developed them with a rapidity almost phenomenal, for they are all yet in their infancy, and on a scale commensurate with the dignity of the metropolis of America. The cordial cooperation of a municipality with public-spirited citizens to build and maintain such institutions for the welfare of the people and of science, finds here, in New York, its maximum evolution, which has as yet, however, by no means reached its complete development nor its maximum usefulness. What shall be said of their position and importance when after fifty years the New York Historical Society opens the tablet which we now place upon this bridge? And, what discoveries will science have made for the benefit of the human race during these next fifty years?

The selection of this bridge recently constructed by the park department, as a permanent memorial of Linnæus, is most appropriate. It is situated just outside the New York Zoological Park, with the New York Botanical Garden a short distance to the north, being thus between the two institutions which teach the subjects on which the fame of Linnæus chiefly rests. The suggestion that it be known hereafter as the Linnæus Bridge came from the Director of the American Museum of Natural History.

On behalf of the New York Academy of Sciences I now unveil this tablet and present it to the city of New York, there having been placed in it copies of to-day's program and other documents befitting the occasion.

SCIENTIFIC NOTES AND NEWS

Dr. Frederick L. Dunlap, instructor in the University of Michigan, has been appointed associate chemist in the Bureau of Chemistry, and will be a member of the board of food and drug inspection. The other members of this board are Dr. H. W. Wiley, chairman, and George P. McCabe, solicitor of the department.

The Vienna Academy of Sciences has awarded its Baumgarten prize (2,000 Kr.) to Dr. Egon Ritter v. Schweidler, professor of physics in Vienna, for his work on the phenomena of dielectrics; the Lieben prize (2,000 Kr.) to Dr. H. Benndorf, associate professor of physics at Graz, for his work on the transmission of earthquake-waves in the interior of the earth, and the Haitinger prize (2,500 Kr.) to Dr. Robert Kremann, docent at Graz, for his work on the esters.

Dr. E. Ray Lankester, retiring director of the natural history department of the British Museum, has been knighted on the occasion of the birthday of King Edward.

Cambridge University proposes to confer, in connection with the celebration of the centenary of the Geological Society, London, in September next, the degree of doctor of science upon Waldemar Cristopher Brögger, professor of mineralogy and geology in the University of Christiania; Geheimrath Hermann Credner, director of the Geological Survey of Saxony, professor of geology in the University of Leipzig, Professor Louis Dollo, curator in the Royal Museum of Natural History, Brussels; Albert de Lapparent, professor of geology and mining in the Catholic Institute, Paris; Professor Alfred Gabriel Nathorst, keeper of the department of fossil plants in the State Museum of Sweden, Stockholm; and Geheimrath Professor Heinrich Rosenbusch, professor of geology and mineralogy in the University of Heidelberg.

The University of Michigan has conferred the honorary doctorate of science on Mr. Carlos B. Cochran, professor of physical science of the West Chester Normal School and state analyst of Pennsylvania.

At the seventy-third annual meeting of the Royal Statistical Society, its Guy medal in gold was awarded to Professor F. Y. Edgeworth for his special services to statistical science, and for his many important and valuable contributions to the transactions of the society. A Guy medal in silver was awarded to Mr. N. A. Humphreys for his recent paper on "The Alleged Increase of Insanity." The subject of the essays for the Howard medal competition, 1907–8, was announced to be "The Cost, Conditions and Results of Hospital Relief in London."

THE Hanbury gold medal has been conferred on Dr. David Hooper, curator of the economic and art sections of the Indian Museum of Calcutta.

M. ST. C. HEPITES has retired from the direction of the Rumanian Meteorological Institute at Bukharest, after having held the office for twenty-three years. He is succeeded by M. I. St. Murat.

DR. GRAHAM-SMITH, Dr. Nuttall and Professor Woodhead have been nominated to represent Cambridge University at the International Congress of Hygiene and Demography to be held in Berlin in September.

PROFESSOR HERMANN VON IHERING, director of the Museo Paulista, São Paulo, Brazil, will represent the museum at several scientific conferences to be held this year in Europe. During his absence Mr. Rodolpho von Ihering will have charge of the museum.

PROFESSOR A. S. HITCHCOCK, systematic agrostologist, U. S. Department of Agriculture, has returned to Washington after five months spent in Europe studying the types of American grasses in the herbaria at Antwerp, Brussels, Paris, Madrid, Padua, Florence, Geneva, Munich, Vienna, Graz, Prague, Halle, Göttingen, Berlin, St. Petersburg, Stockholm and London. Much valuable material in the way of photographs, drawings and portions of types was secured for the national herbarium.

DR. CHARLES A. DAVIS, of the University of Michigan, who has recently completed a report on the peat deposits of Michigan, has been engaged by the United States Geological Survey to make a reconnaisance survey of the peat formations of the coastal plain from the Carolinas northward during the summer.

THE Croonian lectures of the Royal College of Physicians, London, have been delivered by Dr. W. J. R. Simpson on "The Plague."

IN connection with the summer school of Columbia University, a course of lectures on recent advances in physics will be given on successive Monday afternoons at 4:30 o'clock in room No. 301, Fayerweather Hall, as follows:

July 15—"The Perception of Color and Theories of Color Vision," Professor F. L. Tufts.

July 22 and 29—"The Resolving Powers of Optical Instruments," two lectures, Professor C. R. Mann.

August 5—"The Phenomena of Radioactivity and Their Bearing on Our Theories of the Structure of Matter," Professor William Hallock.

August 12—"Some Problems in Artificial Illumination," Professor F. L. Tufts.

AT the exercises commemorative of the one hundredth anniversary of Henry Wadsworth Longfellow, at Bowdoin College, it was announced that the daughters of the poet, Miss Alice H. Longfellow, Mrs. Richard H. Dana and Mrs. J. C. Thorpe, have given $10,000 to the college to endow a fellowship in literature in memory of their father.

DR. C. B. WARRING, for many years instructor in mathematics and physics in the Poughkeepsie Military Institute and the author of works on the relation of the Bible to modern science and other subjects, died on July 5, at the age of eighty-two years.

PROFESSOR KUNO FISCHER, professor of philosophy at Heidelberg, and well known for his publications on the history of philosophy, died on July 5, at the age of eighty-three years.

THE deaths are also announced of Dr. Karl Müller, docent in botany in the Technical Institute at Berlin; of Dr. Egon Ritter von Oppolzer, associate professor of mathematics and astronomy at the University of Innsbruck, and of Dr. Hermann, emeritus professor of mechanical engineering in the Technical Institute at Aachen.

THE third Prehistoric Congress of France will be opened at Autun on August 12, under the presidency of Professor Adrien Guébhard, and will close on August 18.

The Journal of the American Medical Association says: "Representatives of the leading anatomic associations of the world gathered at Würzburg, Germany, during the last week of April. Romiti, of Pisa, presided, and numerous communications were presented showing progress in all lines of comparative anatomy and embryology, and general microscopic and macroscopic human anatomy and embry-

ology. The congress was under the auspices of the German *Anatomische Gesellschaft,* forming its twenty-first annual meeting. Four vice-presidents were elected, who will preside in turn at the annual meetings—Waldeyer, of Berlin; Ebner, of Vienna; Stöhr, of Würzburg, and Nicolas, of Nancy. Stöhr is Kölliker's successor at Würzburg, where his assistants are Schultze, Sobotta and Sommer. They have at their disposal the remarkably well-equipped Institute of Anatomy with its unusual collections of specimens and works on anatomy, the Würzburg faculty having made rather a specialty of anatomy under Kölliker's leadership. The *Presse Médicale* for May 22 has a good report of the congress."

The Hudson-Fulton Celebration Commission has set apart the days from September 18 to 26, 1909, as the time for the observances in honor of the three hundredth anniversary of the discovery of the Hudson by Henry Hudson and the one hundredth anniversary of Robert Fulton's first practical application of steam to navigation. The exercises will include the dedication of the Robert Fulton memorial watergate in Riverside Park and various parks and memorials which it is hoped will be erected along the river.

The literature concerning the alcohol and drug problems has grown to such extent in pamphlets, books, papers and studies of every description that it is impossible to keep in touch with everything written on the subject. Hence a society has been formed in Boston, Mass., and incorporated by the laws of the state, called The Scientific Temperance Federation. This society is a bureau for the collection of every pamphlet, book and paper relating to any possible phase of this question. These are to be put on file and tabulated so as to be available for students and writers. A trained specialist will be in charge to furnish abstracts and data, or copies of the papers on file. The society will charge a small membership fee and will be endowed so that its work will be permanent. Already a nucleus has been made and the work begun. Dr. Crothers, of Hartford, Conn., is chairman of the board of directors. Miss C. F. Stoddard, 23 Trull St., Boston, Mass., is the secretary, to whom all inquiries should be addressed.

We learn from *Nature* that an exhibition of engineering models, optical, electrical and scientific instruments, technical education appliances, and tools, is to be held at the Royal Horticultural Hall, Vincent Square, Westminster, S. W., on October 22–26. In addition to exhibits by leading makers, there will be a loan collection of experimental and exhibition models and apparatus, and also lectures and demonstrations in various branches of applied science.

The *annual conversazione* of the Royal Geographical Society was held on June 14 at the National History Museum, South Kensington. Sir George Goldie, Miss Goldie and several members of the council received the guests, who numbered nearly 1,200. The okapi recently obtained by Major Powell-Cotton from the Ituri Forest, Equatorial Africa, was on view, together with a special exhibition of specimens, manuscripts and objects relating to Linnæus, arranged in celebration of the bicentenary of Linnæus's birth.

Dr. G. R. Mansfield, of Harvard University, with a party of students expected to reach Bozeman, Montana, on July 2, where they will outfit with wagons and camp equipment and start for the mountains, visiting first the geological section of the Bridger Range, then the intervening Cretaceous section to the base of the Crazy Mountains, where they will join Professor Wolff, who, assisted by Mr. H. E. Merwin, assistant in mineralogy, is making a revision of the geology of the mountains. The two parties will spend three weeks in a joint study of the eruptive rocks of the range, and of the exposures in the cañons of dikes, sills and stocks; the summer school party then returning to Bozeman and disbanding, Dr. Mansfield returning to the smaller party to study the extinct glaciation of the range.

The annual meeting of the Naples Table Association for Promoting Laboratory Research by Women held its annual meeting April twentieth, at Mount Holyoke College, by invitation of Miss Woolley on behalf of the

college. Miss Sarah E. Doyle, of Providence, was elected president, Mrs. Elizabeth L. Clarke, treasurer and Mrs. Ada Wing Mead, secretary. The Table of the Association at the Zoological Station at Naples has been occupied at different times during the past year by Miss Grace Watkinson, A.B., Smith, 1902, A.M., 1904; Miss Florence Peebles, A.B., Women's College of Baltimore, 1895, Ph.D., Bryn Mawr, 1900, and Miss Anna G. Newell, A.B., Smith, 1900. It has been assigned for the spring of 1908 to Miss Mary J. Hogue, A.B., Women's College of Baltimore, 1905. The next annual meeting will be held in Providence on invitation of Dean King and President Faunce in behalf of the Women's College in Brown University. Nine theses were received in competition for the $1,000 prize offered in 1907. Three of them were sent from foreign countries. The theses showed wider range of endeavor than those received in the two previous contests as they dealt with botanical, anatomical, morphological, physiological and chemical problems. Several were of decided merit, but since, in the opinion of the examiners, no one was of adequate merit to deserve the award, the association voted to exercise its right to withhold the prize. The fourth prize is announced for 1909.

ACCORDING to statistics compiled for the United States Geological Survey by Edward W. Parker, coal-mining expert in charge, the total production of coal in the United States in 1906 was 414,039,581 short tons of 2,000 pounds, valued at $512,610,744. These figures, compared with those of the preceding year, when the output amounted to 392,919,341 short tons, valued at $476,756,963, show an increase of 21,120,240 short tons, or 5.4 per cent., in quantity, and of $35,853,781, or 7.5 per cent., in value. Of the total production in 1906, Pennsylvania contributed 200,546,084 short tons, or 48.4 per cent., in quantity, and $262,182,935, or 51.1 per cent., in value, the larger percentage in the value being due, of course, to the higher value of anthracite, which is produced almost exclusively in that state. The production of coal in 1906 by states was as follows:

State.	Product.	Value.
Alabama	13,107,663	$17,467,886
Arkansas	1,864,518	2,999,774
California and Alaska	30,831	78,684
Colorado	10,114,074	12,738,509
Georgia and North Carolina	363,463	407,247
Idaho and Nevada	6,165	24,238
Illinois	41,497,435	44,742,440
Indiana	12,084,281	13,105,168
Indian Territory	2,859,450	5,481,053
Iowa	7,321,639	11,688,598
Kansas	6,010,858	8,935,195
Kentucky	9,673,536	9,794,823
Maryland	5,434,528	6,473,829
Michigan	1,336,338	2,402,529
Missouri	3,755,778	6,163,449
Montana	1,787,934	3,186,620
New Mexico	1,963,558	2,635,571
North Dakota	300,998	437,894
Ohio	27,729,843	30,386,297
Oregon	79,731	212,338
Pennsylvania:		
Anthracite	71,282,411	131,917,694
Bituminous	129,263,673	130,265,241
Tennessee	6,262,686	7,682,121
Texas	1,160,707	2,058,731
Utah	1,773,847	2,411,992
Virginia	4,275,815	4,207,521
Washington	3,276,184	5,908,434
West Virginia	43,276,485	40,777,382
Wyoming	6,138,152	8,019,486
Total	414,039,581	$512,610,744

THE Meteorological Service of the Dominion of Canada is now sending time signals from the observatory at St. John, of which Mr. D. L. Hutchinson is director, by telegraph to the wireless station at Camperdown, where special apparatus has been installed to automatically transmit the signals to ships at sea within the zone of that station. Time signals will be sent each week day morning as follows: Beginning at 9h. 58m., A.M., Atlantic time, dots are made each second up to and including 9h. 58m. 57s., then a pause of two seconds, followed by a dot at 9h. 59m.; then another pause of two seconds follows; the clock then makes dots each second up to and including 9h. 59m. 50s.; a pause is then made, followed by a dot at 10h. A.M., Atlantic or Standard time of the 60th meridian west longitude, equivalent to 2h., P.M., Greenwich mean time.

UNIVERSITY AND EDUCATIONAL NEWS

The total amount of money received from the state for the maintenance of the University of Wisconsin is now more than a million dollars a year, in addition to the funds received from the federal government, from endowment and from fees.

The University of Colorado, at Boulder, will receive by the will of the late Andrew J. Mackey of that city funds amounting to about $250,000 to be used in the erection of an auditorium and main building. Another gift to the university of $100,000 for a building has been promised by a Denver citizen. The last legislature appropriated $100,000 for building purposes.

The Paris medical faculty has recently announced that henceforth the incumbents of the special chairs of anatomy, histology, physics, chemistry and pharmacology will not be allowed to take posts as physicians or surgeons in the hospitals. Professors of these branches will be obliged to agree to devote themselves exclusively to their educational work.

According to *The Experiment Station Record,* a practical school of agriculture was opened at Talca on June 29, 1906, under the directorship of Carlos Echeverria Cazotte. The school was started with an appropriation of $71,000 for land and $28,000 for equipment and maintenance. The director is also professor of agriculture and zootechny and is assisted by professors of forestry, physical and natural sciences, engineering, viticulture and the common elementary branches.

Foreign journals report that the German Colonial Secretary, Herr Dernburg, recently visited Hamburg to inspect the Institute for Tropical Diseases, the Botanical Museum, and the Museum for Ethnology and Anthropology with a view to ascertain whether the city possessed facilities enough for the study of colonial and tropical questions to justify the foundation of a colonial training college. Herr Dernburg decided to recommend the establishment of such an institution, and the courses at the new college are to be open to those who desire to engage in private commercial or industrial enterprise in the German colonies, as well as to government officials. The new institute will be modeled on the plan of existing German technical colleges. The promoters of the scheme hold that the intercourse between intending officials and young business men will contribute to the benefit of the German colonies. The state of Hamburg will for the present be responsible for the scheme, and, if the results prove satisfactory, the institution will receive official recognition in the form of an imperial subsidy.

The General Board of Studies of Cambridge University recommends that the present lectureship in physiological and experimental psychology be not continued, but that in its place two lectureships be established, one in the physiology of the senses in connection with the special board for biology and geology, and that the annual stipend of the lecturer be £100; the other in experimental psychology in connection with the special board for moral science, and that the annual stipend of the lecturer be £50.

Professor J. Playfair McMurrich has resigned the professorship of anatomy in the University of Michigan to accept a similar position in the University of Toronto.

In the College of the City of New York, tutors have been elected as follows: Charles A. Corcoran in physics; Howard C. Griffin in chemistry; and C. A. Touissaint in mathematics.

Professor John O. Reed has been appointed dean of the Department of Literature, Science and the Arts in the University of Michigan, to succeed Professor Hudson, who has resigned the position as dean, but retains the professorship of history. Professor Reed has already had experience in administrative matters, as principal of the schools of Saginaw, as professor of physics in the University of Michigan and as dean of the university summer session.